RANGE IMPROVEMENT NOTES

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INDEX

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STATEMENT OF PURPOSE

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This publication is printed primarily to inform professional range administrators of important range improvement and management developlemts and findings. These "NOTES" may include extracts of published papers, unpublished preliminary reports of research work, unpublished reports on administrative studies and personal observations or suggestions of other range administrators. No claim is made as to the accuracy or completeness of studies or conclusions drawn.

All who read these RANGE IMPROVEMENT NOTES are encouraged to submit material for publication, or suggestions for improving its usefulness. Full credit will be given for any material used.

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FIELD DAY PROGRAM
August 25, 1966, at the
GREAT BASIN EXPERIMENTAL AREA - Ephraim, Utah*

CONVERSION OF THICKET COVERED AREAS TO PRODUCTIVE GRAZING LANDS

Ephraim Canyon - Elev. 7,300 ft. Average annual precipitation - 16 inches.

The response of oak thickets and other areas covered by dense groups of shrubs to treatment by a pipe harrow followed by seeding is shown in Ephraim Canyon. The oak- and shrub-covered areas had to be knocked down and then seeded to adapted, competitive herbs. This treatment has increased production of forage and has made the brushlands much more usable to livestock and game.

The area was harrowed in November 1962 and then was seeded to the mixture shown in the accompanying tabulation at the rate of 15 pounds per acre. Part of the area was harrowed once, part twice. Double treatment reduced competition from oak more efficiently than the single treatment, but this difference is less noticeable today than it was a year or two ago. Intermediate wheatgrass, smooth brome, and crested wheatgrass have maintained themselves as fully competitive stands.

Pipe harrows, anchor chains, bulldozers, and heavy disk plows have been used successfully for reducing brush thickets and in preparing a suitable seedbed for adapted herbs. Anchor chaining has been the least expensive treatment where terrain permitted. Costs for double chaining ranged from $6 to $12 per acre. In some areas, where it was feasible, fire has been used successfully in reducing competition.

Broadcast seeding, preferably from the air in late fall, has been the most effective and economical method of seeding.

Rate of Seeding Used for Converting Brushy Areas

Species	Lbs./Acre
Crested wheatgrass	2
Intermediate wheatgrass	2
Bearded bluebunch wheatgrass	1
Smooth brome	2
Great Basin wildrye	1
Alfalfa	2
Cutleaf balsamroot	2
Arrowleaf balsam root	2
Utah sweetvetch	1
Total	15

*Sponsored by Intermountain Forest and Range Experiment Station, U. S. Forest Service, and Utah State Department of Fish and Game, with cooperation of Utah State Agricultural Extension Service.

Two sod-forming grasses (intermediate wheatgrass and smooth brome) and fairway crested wheatgrass have proved to be well suited and competitive for use in drier openings. These grasses were the basic part of the seed mixture used at this location. Other species shown in the list, especially alfalfa, balsamroot, and Utah sweetvetch, provided variety and helped keep the quality of the herbage high.

Quick establishment of a competitive cover of herbs is especially important in the conversion of brush thickets. This herbage keeps the brush open and retards its growth so that foliage is more palatable and more readily available to grazing animals. Of added importance has been the opening of the thickets so that grazing animals can readily move through them.

Observations over a 3-year period show that regrowth of oak on the treated area was grazed by mule deer to an average of 56 percent in the winter. In contrast, utilization of the untreated oak was less than 10 percent. In addition, deer grazed the foliage of the treated site in the summer up to about 10 percent. Average use for the treated and seeded oak sites was 65 deer days per acre. This is in contrast to an average of 15 deer days on a similar but untreated oak site.

On the adjoining untreated range, 15 to 20 acres are required to support one cow or five sheep for 1 month. After conversion and establishment of the herbs, 2 acres can do the same.

In another treated area, about 800 feet higher, where similar herbs were established in the oak 20 years ago, cattle and sheep have grazed annually as much as 70 percent of the oak. Over an 18-year period, smooth brome and intermediate wheatgrass have been utilized to 70 percent of the current year's growth. On this more heavily grazed area, oak has been maintained at an average height of 24 to 30 inches. Intermediate wheatgrass, smooth brome, and crested wheatgrass have maintained themselves as fully competitive stands.

Grazing is important in keeping brush from growing beyond animals' reach, but equally important is competition from understory plants. Figure 1 shows the accumulated height of oak on an area where intermediate wheatgrass and smooth brome were established as an understory after a burning treatment 11 years ago. This is contrasted with a similar area where oak was burned but where no competition was present. Treatment by other methods mentioned above would have produced similar results. The accumulated growth on oak sites that were seeded has been maintained at an average of about 40 inches, whereas on nonseeded sites the oak has grown to an average height of 100 inches and the clumps have again become impenetrable thickets.

Over an 11-year period, oak and seeded grasses have contributed comparable volumes to the total herbage (Fig. 2). The seeded grasses have restricted

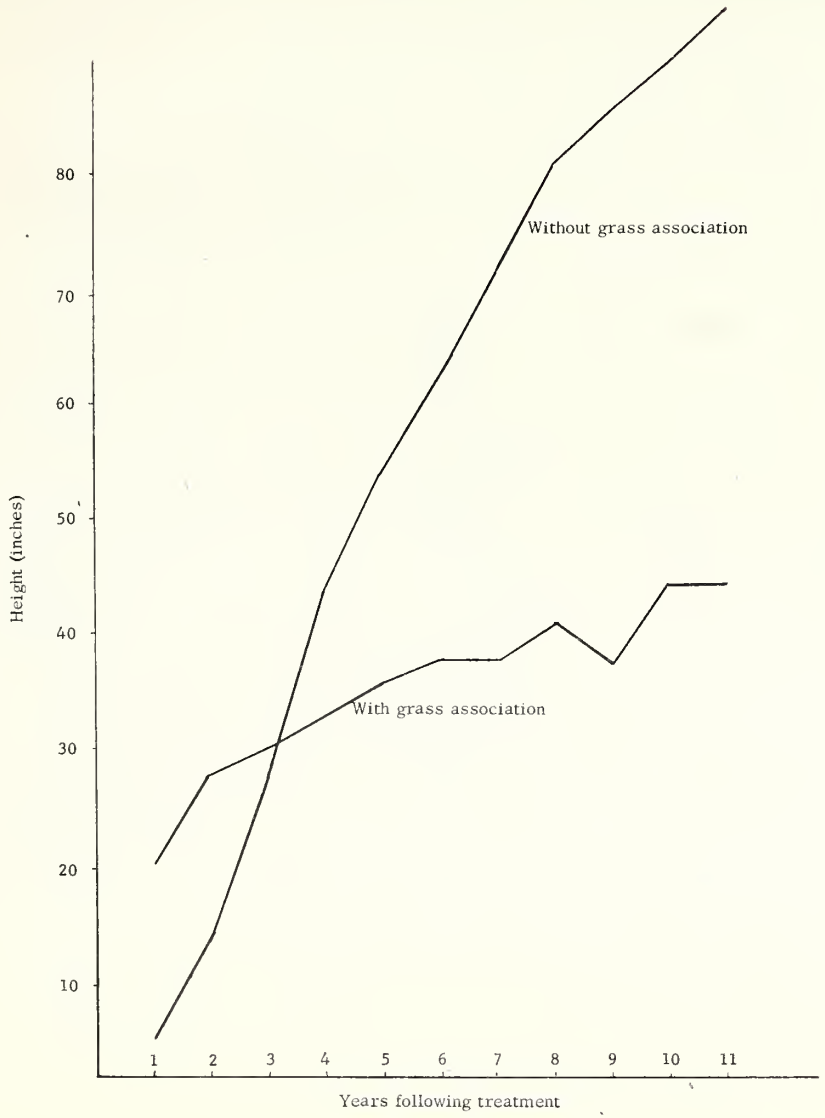

Figure 1.--Oak regrowth height in inches over an 11-year period with and without grass association.

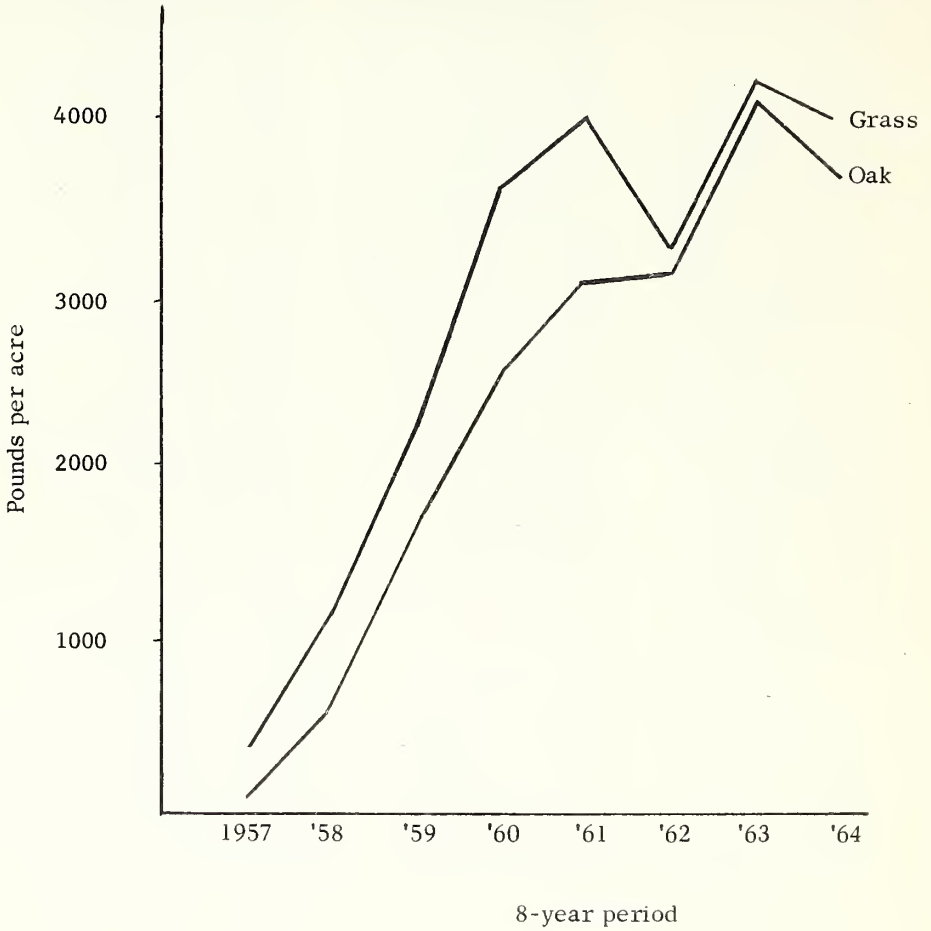

Figure 2.--Yields for grass and oak growing in association over an 8-year period.

the regrowth of oak on treated sites by more than 60 percent and have provided a large volume of forage. Grass production the first year after seeding was 400 pounds of herbage per acre; this increased to 1,200 and 2,200 pounds per acre in the second and third years. Seeded grasses usually are fully established and are providing maximum forage in the third or fourth year after seeding.

Broadcast seeding just before leaf fall is another treatment that has proved successful in opening stands of such tall-growing shrubs as gambel oak and black chokecherry. This treatment has been successful chiefly on the higher, more favorable sites. However, use of broadcast seeding alone (that is, without first knocking down the brush) usually requires 6 to 10 years, whereas only 3 to 4 years are required for establishment of herbs when the oak has been knocked down just before seeding.

This technique has the further disadvantage of allowing the foliage of the shrubs to remain out of reach of grazing animals. However, once a competitive understory is established, chaining down of the overstory stimulates the desired sprouting. Another handicap of seeding into oak overstory is that only shade-tolerant species grow well. However, the broadcast seeding is a justifiable procedure on many thousands of acres where stimulation of browse is not important.

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RAIN OR SHINE

PLAY IT SAFE - ALL THE TIME

GRASSES AND BROADLEAVED HERBS FOR IMPROVING RANGES

Major's Flat, Ephraim Canyon - Elev. 7,200 ft. Av. ann. precip. - 16 in.

Through the past 25 years, much attention has been given to selecting and testing grasses that would improve rangelands. Many good species have been discovered, and several are being used. Much less effort has been spent in finding adapted broadleaved herbs and shrubs that are frequently required for improving ranges--especially game ranges. Consequently, during the past 10 years, the cooperative research by Intermountain Forest and Range Experiment Station and the Utah Department of Fish and Game has given primary attention to discovering desirable species and strains of broadleaved herbs and shrubs. In addition, we have kept trying grasses from new sources in hope of finding types that will better serve specific needs on depleted winter game range in Utah.

We first screen out the most promising species and strains obtained from domestic and foreign exploration and from plant breeding stations. The plots where we plant these selected seeds are small so as to accommodate the usually small amounts of seed or material obtained for transplanting.

First trials are made on a favorable mountain-brush test site, which is near the upper edge of the juniper-pinyon belt. We make similar tests 1,500 feet below on a much more severe site. When it seems advisable, we make similarly restricted test plantings of selected species in southwestern Utah in the Lower Sonoran Zone as well as on higher summer ranges. These first trials enable us to make an initial evaluation of a specie's amplitude of adaptation.

Species and strains that perform best in these first trials are later planted in larger range and pilot test areas where seeding for range improvement is programmed or is underway. Here they may be planted alone or in mixture by methods that have been found workable for the given site.

Nearly 250 species of broadleaved herbs are now being tested at Major's Flat. These have come from several foreign countries as well as from domestic sources. Of course, we are especially interested in legumes because they provide soil nitrogen for use by themselves and associated species. Some special accessions, such as sickle or yellow blossom alfalfa, look especially promising, as do several hybrids of sickle alfalfa and common alfalfa. Rambler and ladak alfalfas, two stabilized crosses of these alfalfas, are already being used.

Chickpea milkvetch, sickle milkvetch, and silky lupine appear likely to be seeded extensively on rangelands within the mountain brush and juniper-pinyon range types as soon as adequate seed sources can be developed. Crownvetch, a legume that has shown special usefulness for healing erosion in eastern States, appears to have similar value for use on mountain rangelands in Utah.

Table 1 lists 10 of the best performing legumes and 10 of the most promising nonlegumes that are now being tested at Major's Flat.

Table 1. --Ten legumes and ten nonleguminous plants useful for extended planting on winter game range

Common name	Scientific name
LEGUMINOUS HERBS	
Chickpea milkvetch	*Astragalus cicer*
Sickle milkvetch	*A. falcatus*
	A. galegiformis
Snakeriver plains milkvetch	*A. stenophyllus*
Crownvetch	*Coronillia varia*
Utah sweetvetch	*Hedysarum utahense*
Silky lupine	*Lupinus sericeus*
Sickle alfalfa	*Medicago falcata*
Rambler, nomad, and ladak	*M. sativa*
Bramble vetch	*Vicia tenuifolia*
NONLEGUMINOUS HERBS	
Spreading aster	*Aster adscendens*
Smooth aster	*A. glaucodes*
Arrowleaf balsamroot	*Balsamorhiza sagittata*
Patch buckwheat	*Eriogonum neglectum*
Oneflower helianthella	*Helianthella uniflora*
Nuttals lomatium	*Lomatium nuttalli*
Lewis flax	*Linum lewisi*
Palmer penstemon	*Penstemon palmeri*
Small burnet	*Sanguisorba minor*
Gooseberryleaf globemallow	*Sphaeralcea grossulariaefolia*

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The average man doesn't want to paddle his own canoe these days

He wants a motor on it.

IMPROVING DEPLETED JUNIPER-PINYON RANGE

Lower testing area on Robert Rasmuson's Field - Ephraim Canyon
Elevation 5,800 feet Average annual precipitation - 11 in.

From one-fourth to one-third of the State of Utah is occupied by closed or closing juniper-pinyon woodlands. As a consequence, the valuable herbs and shrubs have been lost, and with them has gone the value of the land for grazing. Much of this loss of forage results from invasion of trees beyond the areas they originally occupied, but a great deal of it also results from the increased number of trees within the original boundaries of the type. Whether from thickening of the stand or from aggressive invasion, the final result has been the same--loss of range for big game and livestock. This site is typical of the lower edge of the juniper-pinyon type where stands have thickened from probably 50 trees per acre to some 250 to 300 per acre during the past 70 to 80 years. Closed stands of these trees may support as few as 200 trees per acre or as many as 1,500 per acre.

Large barren areas between trees and clusters of trees are characteristic. At this site, about 50 percent of the land area is barren openings. These give rise to immediate runoff and erosion during high-intensity summer showers. Surface soil in these openings is permeated by millions of feeder rootlets that efficiently take up the moisture and the nutrients.

The skeleton remains of shrubs and grasses are mute evidence of the former abundance of forage. Important plants in the understory were antelope bitterbrush, fourwing saltbush, big sagebrush, black sagebrush, Brigham tea, bluebunch wheatgrass, and Indian ricegrass. Opening such a stand provides immediate opportunity for suppressed plants to grow and for seeded plants to become established and develop.

A few suppressed plants of cheatgrass brome immediately developed into a full stand on the area where trees were killed by singeing with a torch 10 years ago. This annual grass makes a good dispersed cover but unfortunately becomes a serious fire hazard when mature. Perennials have been slowly occupying this site and are gradually choking out the cheatgrass where the understory plants have been seriously depleted. In such areas, it pays to plant a variety of species including grasses, broadleaved herbs and shrubs.

ADAPTED SHRUBS

Several shrubs are being used to advantage in restoring depleted juniper-pinyon ranges and some adjacent ranges. Shrubs that show most promise for use in artificial restoration of range include fourwing saltbush, antelope bitterbrush, serviceberry, black sage, big sagebrush, winterfat, and rubber rabbitbrush. Shrubs of the same species, but imported from different sources, have differed greatly in height growth and forage yield (Table 2).

Selection and breeding are excellent means for improving shrubs for use on severe sites. Hybridization has been observed in natural stands between species of bitterbrush, saltbush, sagebrush, mountain mahogany, serviceberry, and oak. Exploratory trials have shown that artificial hybridization can be effected readily between species within oak and saltbush complexes. Several intergeneric crosses have been successful. Black greasewood, spiney hopsage, and spineless hopsage have been used successfully to pollinate bushes of fourwing saltbush. We are now awaiting maturity of more than 300 hybrid seedlings from these crosses. We are planning more research on the possibilities of developing desirable hybrids for use on Utah range.

Table 2.--Variation in height and yield of 10 species of shrubs from different sources

Shrub	Height		Yield	
	Highest	Lowest	Greatest	Least
	- - - Inches - - -		- - - Lbs./acre - - -	
Saskatoon serviceberry	21	8	100	10
Big sagebrush	35	11	250	15
Fourwing saltbush	46	8	350	12
Curlleaf mahogany	29	5	225	10
Mountain mahogany	23	6	70	10
Rubber rabbitbrush	20	8	150	15
Common winterfat	20	4	100	6
Cliffrose	20	9	45	10
Antelope bitterbrush	25	4	140	10
Hybrid (Purshia and Cowania)	27	8	80	12

APPLICATION OF RESULTS OF RESEARCH

Manti Face Restoration Project, South Manti - Elevation 5,700 feet
Average annual precipitation - 12 inches

This 600-acre restoration project used to be a closed stand of juniper-pinyon with about 400 trees per acre. In November 1961, it was chained twice and was seeded aerially between chainings. The results are representative of what we have obtained on more than 60,000 acres of depleted winter game range in Utah.

On this project we used plant species and a chaining technique that had proved well suited in previous trials. Costs for this restoration were near the average for the 60,000 acres treated in Utah--about $12 per acre. This cost was about equally divided between treatment and seed.

The terrain here is fairly steep--an average slope of about 25 percent. Before treatment, it was a flood-producing area. Runoff water from high-intensity summer storms had caused considerable property damage in Manti. Since treatment there has been no runoff; former gully bottoms are stable and are supporting well-established vegetation.

Several projects like this, completed during the past 8 years by the Utah Department of Fish and Game, are being grazed by game in the winter and by cattle in late May and June. The Department plans to graze this area by cattle next year. A recent survey of deer droppings indicated that 60 deer days of grazing per acre were used during the past winter and spring. This compares with about 6 days per acre before treatment. Restoration of this and similar poor range areas has greatly lessened damage to agricultural crops at lower elevations. Before treatment, this area had virtually no value for livestock. We now estimate that 3 acres can support one cow for 1 month; and if animals are properly distributed there should be no damage to the range. Certainly the total benefits from restoration projects in juniper-pinyon range areas in ensuing years should be highly rewarding.

The seed mixture of nine species shown in the accompanying list was aerially broadcast after the first chaining. The second chaining covered the seed and removed some trees that had not been killed by the first chaining. Local sportsmen did some additional hand planting of selected shrubs--antelope bitterbrush, fourwing saltbush, and cliffrose.

Before treatment, this area provided less than 70 pounds of understory herbage per acre. Total ground cover, including the trees, was about 3 percent. Table 3 shows the production and the ground cover by various

types of vegetation on a seeded area in 1964, the third year after treatment. The nearly full stand of seeded species produced 1,600 pounds of forage per acre and was making 89 percent ground cover. The forage production for seeded and native grass and forb species combined can be expected to increase above the figures shown here. Production is probably lower this year because the season has been exceptionally dry. Shrubs are now producing a fairly small proportion of the total, but they will produce more in future years.

Seed Mixture Sown at Manti Face Restoration Project - November 1961

Species	Lbs./acre
Crested wheatgrass	
Fairway - 2; Standard - 2	4
Intermediate wheatgrass	2
Pubescent wheatgrass	2
Smooth brome	1
Russian wildrye	1
Alfalfa	
Ladak - 0.5; Nomad - 0.5	1
Yellow sweetclover	0.5
Big sagebrush	0.5
Rubber rabbitbrush	0.5
Total	12.5

Seeded grasses provide the major portion of the forage (Table 3). Crested wheatgrass is the most abundant, but intermediate wheatgrass, Russian wildrye, and smooth brome are growing well and are contributing importantly to forage production. Native grasses have responded to the treatment and are reoccupying their former position in the understory. Native forbs have recovered more slowly. Nomad and ladak alfalfas are taking an important place in the vegetation. Alfalfa is producing about 180 pounds of forage per acre and is maintaining itself well in association with grasses. A recent survey showed that alfalfa was the only species that had increased ground cover since 1964. This is especially significant because the past growing season has been one of the driest on record.

The most marked change on this area since treatment 5 years ago has been the nearly complete elimination of cheatgrass brome. At first this annual quickly occupied much of the area. In 1964, there was less of it than in the first 2 years after the trees had been removed; but its 377,000 plants per acre were making a 12-percent ground cover. Right now, some 26,000 plants per acre are making a cover of less than one-half of 1 percent. Cheatgrass produces about 1 pound of forage per acre. It may be almost

completely suppressed in a juniper stand, but it springs into abundance after tree competition is eliminated. However, developing perennials usually suppress it within 3 to 5 years.

Table 3. --Pounds of herbage produced per acre and percent ground cover by plant types, 1964

Plant types	Yield	Ground cover
	Lbs. /acre	Percent
Seeded grass	1, 100	35. 4
Native grass (perennial)	142	4. 8
Native grass (annual)	56	12. 0
Seeded forbs	179	3. 7
Native forbs (perennial)	45	.. 8
Native forbs (annual)	7. 6	. 1
Shrubs	76	1. 4
Total production (exclusive of trees)	1,605. 6	
Trees	329	4. 5
Litter		26. 5
Total vegetal cover		89. 2
Bare ground		10. 8

THOUGHT FOR THE DAY

Most of us don't put our best foot forward
until
we get the other one in hot water.


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